



#1

SEQUENCE LISTING

Cahoon, Rebecca E.
Hitz, William D.
Thorpe, Catherine J.
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<120> PHYTIC ACID BIOSYNTHETIC ENZYMES

<130> BB1165 US NA

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<150> 60/082,960

<151> 1998-04-24

<150> PCT/US99/08790

<151> 1999-04-22

<160> 24

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<210> 1

<211> 462

<212> DNA

<213> Oryza sativa

<400> 1

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<210> 2

<211> 114

<212> PRT

<213> Oryza sativa

<400> 2

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      20             25             30
His Lys Gly Gln Val Asp Leu Val Thr Glu Thr Asp Lys Ala Cys Glu
      35             40             45
Asp Leu Ile Phe Asn His Leu Arg Lys His Tyr Pro Asp His Lys Phe
      50             55             60
Ile Gly Glu Glu Thr Ser Ala Gly Leu Gly Ala Thr Ala Asp Leu Thr
      65             70             75             80
Asp Asp Pro Thr Trp Ile Val Asp Pro Leu Asp Gly Thr Thr Asn Phe
      85             90             95
Val His Gly Phe Pro Phe Val Cys Val Ser Ile Gly Leu Thr Val Gly
      100            105            110
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Lys Ile
114

<210> 3
<211> 561
<212> DNA
<213> Glycine max

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<400> 3

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tcacaattgg aaaaatctac aattgggtgt gtatacaatc aatataatga cttttctgga 480
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<210> 4
<211> 168
<212> PRT
<213> Glycine max

<400> 4
Met Val Asp Asn Asp Ser Leu Ser Glu Phe Leu Ala Ser Ala Val Asp
1 5 10 15
Ala Ala Gln Lys Ala Gly Glu Ile Ile Arg Lys Gly Phe Tyr Gln Thr
20 25 30
Lys Asn Val Glu His Lys Gly Gln Val Asp Leu Val Thr Glu Thr Asp
35 40 45
Lys Ala Cys Glu Glu Leu Ile Phe Asn His Leu Lys Gln Leu Tyr Pro
50 55 60
Thr His Lys Phe Ile Gly Glu Glu Thr Thr Ala Ala Tyr Gly Thr Thr
65 70 75 80
Glu Leu Thr Asp Glu Pro Thr Trp Ile Val Asp Pro Leu Asp Gly Thr
85 90 95
Thr Asn Phe Val His Gly Phe Pro Phe Val Cys Val Ser Ile Gly Leu
100 105 110

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<211> 267
<212> PRT
<213> Triticum aestivum

<400> 8
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Ala Gly Glu Ile Ile Arg Lys Ser Phe Tyr Leu Ser Lys Lys Val Glu
20 25 30
His Lys Gly Gln Val Asp Leu Val Thr Glu Thr Asp Lys Ala Cys Glu
35 40 45
Asp Leu Ile Phe Asn His Leu Arg Met Leu Tyr Pro Asp His Lys Phe
50 55 60
Ile Gly Glu Glu Thr Ser Ala Ala Leu Gly Ser Thr Asp Asp Leu Thr
65 70 75 80
Tyr Asp Pro Thr Trp Ile Val Asp Pro Leu Asp Gly Thr Thr Asn Phe
85 90 95
Val His Gly Phe Pro Phe Val Cys Val Ser Ile Gly Leu Thr Ile Gly
100 105 110
Lys Ile Pro Thr Val Gly Val Val Tyr Asn Pro Ile Met Asn Glu Leu
115 120 125
Phe Thr Ala Val Arg Gly Lys Gly Ala Phe Leu Asn Gly Ser Pro Ile
130 135 140
Lys Thr Ser Pro Gln Asn Glu Leu Val Lys Ala Leu Met Val Thr Glu
145 150 155 160
Val Gly Thr Lys Arg Asp Lys Ser Thr Leu Asp Asp Thr Thr Asn Arg
165 170 175
Ile Asn Lys Leu Leu Phe Lys Ile Arg Ser Ile Arg Met Cys Gly Ser
180 185 190
Leu Ala Leu Asn Met Cys Gly Val Ala Cys Gly Arg Leu Asp Leu Cys
195 200 205
Tyr Glu Ile Gly Phe Gly Gly Pro Trp Asp Val Ala Ala Gly Ala Leu
210 215 220
Ile Leu Lys Glu Ala Gly Gly Phe Val Phe Asp Pro Ser Gly Asp Glu
225 230 235 240
Phe Asp Leu Met Ala Gln Arg Met Ala Gly Ser Asn Gly His Leu Lys

Asp Gln Phe Ile Lys Ala Leu Gly Asp Ala Ser
260 265

<210> 9
<211> 1090
<212> DNA
<213> Hordeum vulgare

<400> 9
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gtgcattgat ccttttagatg gaacaacaaa ctttgcacat ggttacccca gcttttctgt 180
atccattggg gttctttatc gaggcaagcc tgctgctgcc actgtggtgg aattttgtgg 240
tgggcctatg tgctggagca ctctgacaat ttctgcatct tctggcaaag gtgcttattg 300
taatgggcaa aaaattcatg tcagtccaac agaaaagggtg gaacagtcct ttctggtaac 360
tgggttttga tatgaacatg atgatgcatg gctcaccaat ataaaattgt tcaaggaatt 420
tactgatgtt agcaggggag tacgaaggct aggtctctgct gctgccgata tgtcccatgt 480
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tacagtcttt gatcgttctg ttcttgtttc caatggcggt gttcatgata agcttttga 660
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gagctcgaat gagcttctca ctggattcct tttgctttga tcgaatgtat caggaagaaa 960
tgtttgcaaa aggtgttgta tgcattggtc cagcctgttg tacttggaat aatataactg 1020
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aaaaaaaaaa 1090

<210> 10
<211> 249
<212> PRT
<213> Hordeum vulgare

<400> 10
His Glu Asp Lys Leu Ser Glu Ser Val Ile Leu Glu Val Val Thr Lys
1 5 10 15
Asn Phe Arg Asp His Leu Ile Leu Gly Glu Glu Gly Gly Leu Ile Gly
20 25 30
Asp Ser Leu Ser Glu Tyr Leu Trp Cys Ile Asp Pro Leu Asp Gly Thr
35 40 45
Thr Asn Phe Ala His Gly Tyr Pro Ser Phe Ser Val Ser Ile Gly Val
50 55 60
Leu Tyr Arg Gly Lys Pro Ala Ala Ala Thr Val Val Glu Phe Cys Gly
65 70 75 80
Gly Pro Met Cys Trp Ser Thr Arg Thr Ile Ser Ala Ser Ser Gly Lys
85 90 95
Gly Ala Tyr Cys Asn Gly Gln Lys Ile His Val Ser Pro Thr Glu Lys
100 105 110
Val Glu Gln Ser Leu Leu Val Thr Gly Phe Gly Tyr Glu His Asp Asp
115 120 125
Ala Trp Leu Thr Asn Ile Asn Leu Phe Lys Glu Phe Thr Asp Val Ser
130 135 140
Arg Gly Val Arg Arg Leu Gly Ser Ala Ala Ala Asp Met Ser His Val
145 150 155 160

Gly Leu Gly Ile Thr Glu Ala Tyr Trp Glu Tyr Arg Leu Lys Pro Trp
165 170 175
Asp Met Ala Ala Gly Val Leu Ile Val Glu Glu Ala Gly Gly Val Val
180 185 190
Thr Arg Met Asp Gly Gly Glu Phe Thr Val Phe Asp Arg Ser Val Leu
195 200 205
Val Ser Asn Gly Val Val His Asp Gln Leu Leu Glu Arg Ile Arg Pro
210 215 220
Ala Thr Glu Asp Leu Lys Lys Lys Gly Ile Asp Phe Ser Leu Trp Phe
225 230 235 240
Lys Pro Asp Lys Tyr Pro Thr Asp Phe
245

<210> 11
<211> 989
<212> DNA
<213> Zea mays

<400> 11
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cttcttaagg tcttcagtag gagggccgat ccggtccaaa agctgtccac acagacaaca 300
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aaacctgtcc atgaacaagt ccgttggaaa caagaacaga gcgatcgaag accgtaaaact 420
ctccaccgtc catgcgagtt accaccccac cagcttcctc tactatcagg acgccagcat 480
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ccttgaacag attcatattg gtctgtccagg catcatcgtg ttcatatcca aaacctgtga 660
cgagaagtga ttgttccacc ttgtctgtct gactgacatg aatcctttgt ccaatataat 720
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aaaattctca ccacttgaa accacacggg ttttcccagg aaagaacaac taatggcaca 840
ggtaaacccg ggggtaccat tggcaaagtt ccttgtctcc accaaagggt aattgcccc 900
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<210> 12
<211> 136
<212> PRT
<213> Zea mays

<400> 12
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Tyr Tyr Ile Gly Gln Arg Ile His Val Ser Gln Thr Asp Lys Val Glu
20 25 30
Gln Ser Leu Leu Val Thr Gly Phe Gly Tyr Glu His Asp Asp Ala Trp
35 40 45
Thr Thr Asn Met Asn Leu Phe Lys Glu Phe Thr Asp Ile Ser Arg Gly
50 55 60
Val Arg Arg Leu Gly Ser Ala Ala Ala Asp Met Ser His Ile Gly Leu
65 70 75 80
Gly Ile Thr Glu Ala Tyr Trp Glu Tyr Arg Leu Lys Pro Trp Asp Val
85 90 95

His Ala Gly Val Leu Ile Val Glu Glu Ala Gly Gly Val Val Thr Arg
 100 105 110

Met Asp Gly Gly Glu Phe Thr Val Phe Asp Arg Ser Val Leu Val Ser
 115 120 125

Asn Gly Leu Val His Gly Gln Val
 130 135

<210> 13
 <211> 492
 <212> DNA
 <213> Zea mays

<220>
 <221> unsure
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<220>
 <221> unsure
 <222> (442)

<220>
 <221> unsure
 <222> (485)

<400> 13
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 gctggtggag gtggcgcaac gggcggcgga cgctgctggg gaggtgctca ngaagtactt 360
 ccgccagcgg gttgagatca tcgacaaaaga ggaccacagt cctgttacia ttgcagatag 420
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 ttgngngaaga ga 492

<210> 14
 <211> 338
 <212> PRT
 <213> Zea mays

<400> 14
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Gly Leu Ala Ser Ala Asn Pro Asn Pro Arg Ser Arg Leu Leu Arg Leu
 20 25 30

Arg Ala Ala Ser Pro Val Ser Ser Ala Val Leu Ser Ala Ser Gly Arg
 35 40 45

Gln Pro Met Ser Thr Val Arg Ala Ser Phe Ala Ala Gly Ala Ala Gly
 50 55 60

Arg Arg Ala Ala Ala Val Gly Glu Leu Ala Thr Glu Arg Leu Val Glu
 65 70 75 80

Val Ala Gln Arg Ala Ala Asp Ala Ala Gly Glu Val Leu Arg Lys Tyr
 85 90 95

Phe Arg Gln Arg Val Glu Ile Ile Asp Lys Glu Asp His Ser Pro Val
 100 105 110

Thr Ile Ala Asp Arg Glu Ala Glu Glu Ala Met Val Ser Val Ile Leu

115					120					125					
Lys	Ser	Phe	Pro	Thr	His	Ala	Ile	Phe	Gly	Glu	Glu	Asn	Gly	Trp	Arg
130						135					140				
Cys	Ala	Glu	Asn	Ser	Ala	Asp	Phe	Val	Trp	Val	Leu	Asp	Pro	Ile	Asp
145					150					155					160
Gly	Thr	Lys	Ser	Phe	Ile	Thr	Gly	Lys	Pro	Leu	Phe	Gly	Thr	Leu	Ile
				165					170					175	
Ala	Leu	Leu	His	Asn	Gly	Lys	Pro	Val	Ile	Gly	Val	Ile	Asp	Gln	Pro
			180					185					190		
Ile	Leu	Arg	Glu	Arg	Trp	Ile	Gly	Val	Asp	Gly	Lys	Gln	Thr	Thr	Leu
		195					200					205			
Asn	Gly	Gln	Glu	Ile	Ser	Val	Arg	Ser	Cys	Asn	Leu	Leu	Ala	Gln	Ala
	210					215					220				
Tyr	Leu	Tyr	Thr	Thr	Ser	Pro	His	Leu	Phe	Glu	Ala	Asp	Ala	Glu	Asp
225						230					235				240
Ala	Phe	Ile	Arg	Val	Arg	Asn	Lys	Val	Lys	Val	Pro	Leu	Tyr	Gly	Cys
			245						250					255	
Asp	Cys	Tyr	Ala	Tyr	Ala	Leu	Leu	Ala	Ser	Gly	Phe	Val	Asp	Ile	Val
			260					265					270		
Val	Glu	Ser	Gly	Leu	Lys	Pro	Tyr	Asp	Phe	Leu	Ser	Leu	Val	Pro	Val
		275					280					285			
Ile	Glu	Gly	Ala	Gly	Gly	Ser	Ile	Thr	Asp	Trp	Arg	Gly	Asp	Lys	Leu
	290					295					300				
His	Trp	Pro	Val	Thr	Ala	Glu	Ser	Arg	Pro	Thr	Ser	Phe	Asn	Val	Val
305						310					315				320
Ala	Ala	Gly	Asp	Ala	Arg	Val	His	Lys	Glu	Ala	Leu	Asp	Ala	Leu	Arg
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Trp Arg

<210> 15
 <211> 593
 <212> DNA
 <213> Oryza sativa

<400> 15
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 acgaagacta ggttctgctg ctgctgacat gtcccacgtt gccctaggca ttacagaagc 180
 ctactgggaa taccgactta agccttgga tatggctgct ggtgttctga tagttgaaga 240
 agctgggtgg atggtgtcac gcatggatgg tggggagttt accgtctttg atcgttctgt 300
 ccttgtttcc aatggtgttg tacatgatca gcttttggat cggattggcc ctgccacaga 360
 agatcttaag aagaaaggaa ttgatttctc cttgtggttt aaaccogaca aataccctac 420
 cgacttttaa gttgaactcc tcaccagag ctattttata ctactagaag aaaagagaaa 480
 aacagaggat cttatgttaa aatgccatgt acttgactga atatttgttt attgaagtcc 540
 tttgactcaa aaaaaaaaaa aaaaaaaaaa tgcagggggg gcoggtacac aat 593

<210> 16
 <211> 142
 <212> PRT
 <213> Oryza sativa

<400> 16
 His Glu Leu Thr Lys Val Glu Gln Ser Leu Leu Val Thr Gly Phe Gly
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 Tyr Glu His Asp Asp Ala Trp Val Thr Asn Ile Asn Leu Phe Lys Glu
 20 25 30
 Tyr Thr Asp Ile Ser Arg Gly Val Arg Arg Leu Gly Ser Ala Ala Ala
 35 40 45
 Asp Met Ser His Val Ala Leu Gly Ile Thr Glu Ala Tyr Trp Glu Tyr
 50 55 60
 Arg Leu Lys Pro Trp Asp Met Ala Ala Gly Val Leu Ile Val Glu Glu
 65 70 75 80
 Ala Gly Gly Met Val Ser Arg Met Asp Gly Gly Glu Phe Thr Val Phe
 85 90 95
 Asp Arg Ser Val Leu Val Ser Asn Gly Val Val His Asp Gln Leu Leu
 100 105 110
 Asp Arg Ile Gly Pro Ala Thr Glu Asp Leu Lys Lys Lys Gly Ile Asp
 115 120 125
 Phe Ser Leu Trp Phe Lys Pro Asp Lys Tyr Pro Thr Asp Phe
 130 135 140

<210> 17
 <211> 1103
 <212> DNA
 <213> Glycine max

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 tcggtaacaa agtcgccgat gctgccggag aagttatccg caaatacttc agaaaaaact 180
 tcgacgttat tcacaaacat gatctcagtc cagtaacatc tgcagatcaa tctgctgagg 240
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 tagcaggaaa gagaacctca ctgaacggac aagaaatc acacgcact tgtgcggacc 540
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 attttcttgc attgattcct gttattgaag gcgctggagg tgtcataact gattggaaag 780
 gagataaact gttttgggaa gcttctccac tttcaatcgc cacaagtttt aatgttgttg 840
 ctgctggtga caaacagatt catcaacaag ctctagattc attgcagtg aagtgatagc 900
 ttgaattaat cttcagtgca aataatcttc tctgcaaag gtcttgattc agatgttcct 960
 aaggacatgt attaccgtac cattttctgg catttaagtt gaaaaccatg tactcagaat 1020
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 gccgtacaaa tctccccgcc ccg 1103

<210> 18
 <211> 295
 <212> PRT
 <213> Glycine max

<400> 18
 Met Phe Ser Gln Cys His Phe Leu Ser His Ser Pro Ile Pro Asn Thr
 1 5 10 15
 Thr Phe Arg Leu Arg Ala Met Ala Pro His Ser Thr Pro Leu Glu Leu
 20 25 30

Asn Arg Phe Ala Glu Val Gly Asn Lys Val Ala Asp Ala Ala Gly Glu
 35 40 45
 Val Ile Arg Lys Tyr Phe Arg Lys Asn Phe Asp Val Ile His Lys His
 50 55 60
 Asp Leu Ser Pro Val Thr Ile Ala Asp Gln Ser Ala Glu Glu Ala Met
 65 70 75 80
 Val Ser Ile Ile Leu Asp Asn Phe Pro Ser His Ala Ile Tyr Gly Glu
 85 90 95
 Glu Asn Gly Trp Arg Cys Glu Glu Lys Asn Ala Asp Tyr Val Trp Val
 100 105 110
 Leu Asp Pro Ile Asp Gly Thr Lys Ser Phe Ile Thr Gly Lys Pro Val
 115 120 125
 Phe Gly Thr Leu Val Ala Leu Leu Gln Asn Gly Thr Pro Ile Leu Gly
 130 135 140
 Ile Ile Asp Gln Pro Val Leu Arg Glu Arg Trp Ile Gly Ile Ala Gly
 145 150 155 160
 Lys Arg Thr Ser Leu Asn Gly Gln Glu Ile Ser Thr Arg Thr Cys Ala
 165 170 175
 Asp Leu Ser Gln Ala Tyr Leu Tyr Thr Thr Ser Pro His Leu Phe Asn
 180 185 190
 Gly Asp Ala Glu Glu Ala Phe Ile Arg Val Arg Ser Lys Val Lys Phe
 195 200 205
 Gln Leu Tyr Gly Cys Asp Cys Tyr Ala Tyr Ala Leu Leu Ser Ser Gly
 210 215 220
 Phe Val Asp Leu Val Val Glu Ser Gly Leu Lys Pro Tyr Asp Phe Leu
 225 230 235 240
 Ala Leu Ile Pro Val Ile Glu Gly Ala Gly Gly Val Ile Thr Asp Trp
 245 250 255
 Lys Gly Asp Lys Leu Phe Trp Glu Ala Ser Pro Leu Ser Ile Ala Thr
 260 265 270
 Ser Phe Asn Val Val Ala Ala Gly Asp Lys Gln Ile His Gln Gln Ala
 275 280 285
 Leu Asp Ser Leu Gln Trp Lys
 290 295

<210> 19
 <211> 1418
 <212> DNA
 <213> Triticum aestivum

<400> 19
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 catggagcgg ctggtggcgg tggcgagag cgcggcggat gcggcggggg aggtgctcag 240
 gaagtacttc aggcagcgt tgcagatcat cgacaaagag gaccacagtc ccgtcacgat 300
 cgctgataga gaagcagaag aagcaatgac ctcagtcata ctgaagagct ttcctactca 360
 tgctgttttc ggtgaggaga acggttggag gtgtgcagag aagtctgctg actatgtttg 420
 ggtcttggac cccatagatg gaacaaagag cttcataact gggaagcctc tttttggtac 480
 gcttattgcg cttcttcaca atggaaaagcc gggtatgggc attattgata agccaatctt 540

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gagagagaga tgggttgggg tggacgggaa gaaaactacc ttaaattggac aagaaatatc 600
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tgaaggagat gctgaagatg cattcattcg tgtacgagac aaggtgaaag tcccattgta 720
tggtgtgat tgttatgctt atgctctcct ggcttctggt tttgtggatc ttgttgttga 780
atctggattg aagccatacg attttctctc gctggtaccg gtgattgaag gagctggggg 840
ctcaataact gattgggaag ggaacaagct ccactggcct gtctcttcgg aatctcggcc 900
aacaagtttc aacgtggtgg cagccggaga ttcccatgtc catgggcagg ccctggcagc 960
gttgcggtgg cgctagcctg cctgcagcac ggggcggctc ctattgttca tttagaaggc 1020
tgcaactgtt attcatctat ccaataaaac tgagtctgta cgcttcctca gtgggtaaag 1080
caagtgtttc acggtgcacc ctttactcaa taatgatcag tggtttcttg ttgtgtgtta 1140
aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa 1200
aaaaaaaaaa aaaaaacaaa aaaaaaaata aaaaaaaaaa aaaacccccg gggggggggc 1260
ggggaccaa tttcccata tttttttttt ttttaccccc ccccaggggg gtttttttta 1320
taaaacttct gaggggggaa aaaccggggg ttttaaccaa taaatcccct tgaacaaaaa 1380
ccccctttcc ccaagggggg taataaaaaa aagggccg 1418

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<210> 20
<211> 324
<212> PRT
<213> Triticum aestivum

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<400> 20
His Glu Thr Lys Pro Ser Leu Pro Tyr His Leu Arg Ser Pro Ser Leu
  1          5          10          15

Leu Ala Thr Phe Ser Ser Ser Ala Ala Gly Arg Ala Cys Gly Ile Ala
      20          25          30

Gly Arg Trp Met Gly Ser Val Arg Ala Ser Pro Ser Glu Ala Gly Gly
      35          40          45

Trp Ala Val Ala Ala Ala Gly Lys Glu Gly Val Asp Met Glu Arg Leu
      50          55          60

Val Ala Val Ala Gln Ser Ala Ala Asp Ala Ala Gly Glu Val Leu Arg
      65          70          75          80

Lys Tyr Phe Arg Gln Arg Phe Glu Ile Ile Asp Lys Glu Asp His Ser
      85          90          95

Pro Val Thr Ile Ala Asp Arg Glu Ala Glu Glu Ala Met Thr Ser Val
      100         105         110

Ile Leu Lys Ser Phe Pro Thr His Ala Val Phe Gly Glu Glu Asn Gly
      115         120         125

Trp Arg Cys Ala Glu Lys Ser Ala Asp Tyr Val Trp Val Leu Asp Pro
      130         135         140

Ile Asp Gly Thr Lys Ser Phe Ile Thr Gly Lys Pro Leu Phe Gly Thr
      145         150         155         160

Leu Ile Ala Leu Leu His Asn Gly Lys Pro Val Met Gly Ile Ile Asp
      165         170         175

Gln Pro Ile Leu Arg Glu Arg Trp Val Gly Val Asp Gly Lys Lys Thr
      180         185         190

Thr Leu Asn Gly Gln Glu Ile Ser Val Arg Pro Cys Asn Val Leu Glu
      195         200         205

Gln Ala Tyr Leu Tyr Thr Thr Ser Pro His Leu Phe Glu Gly Asp Ala
      210         215         220

Glu Asp Ala Phe Ile Arg Val Arg Asp Lys Val Lys Val Pro Leu Tyr
      225         230         235         240

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Gly Cys Asp Cys Tyr Ala Tyr Ala Leu Leu Ala Ser Gly Phe Val Asp
245 250 255

Leu Val Val Glu Ser Gly Leu Lys Pro Tyr Asp Phe Leu Ser Leu Val
260 265 270

Pro Val Ile Glu Gly Ala Gly Gly Ser Ile Thr Asp Trp Glu Gly Asn
275 280 285

Lys Leu His Trp Pro Val Ser Ser Glu Ser Arg Pro Thr Ser Phe Asn
290 295 300

Val Val Ala Ala Gly Asp Ser His Val His Gly Gln Ala Leu Ala Ala
305 310 315 320

Leu Arg Trp Arg

<210> 21
<211> 273
<212> PRT
<213> Lycopersicon esculentum

<400> 21
Met Ala Arg Asn Gly Ser Leu Glu Glu Phe Leu Gly Val Ala Val Asp
1 5 10 15

Ala Ala Lys Arg Ala Gly Glu Ile Ile Arg Lys Gly Phe His Glu Thr
20 25 30

Lys His Val Val His Lys Gly Gln Val Asp Leu Val Thr Glu Thr Asp
35 40 45

Lys Ala Cys Glu Asp Leu Ile Phe Asn His Leu Lys Gln His Phe Pro
50 55 60

Ser His Lys Phe Ile Gly Glu Glu Thr Ser Ala Ala Thr Gly Asp Phe
65 70 75 80

Asp Leu Thr Asp Glu Pro Thr Trp Ile Val Asp Pro Val Asp Gly Thr
85 90 95

Thr Asn Phe Val His Gly Phe Pro Ser Val Cys Val Ser Ile Gly Leu
100 105 110

Thr Ile Gly Lys Ile Pro Thr Val Gly Val Val Tyr Asp Pro Ile Ile
115 120 125

Asp Glu Leu Phe Thr Gly Ile Asn Gly Lys Gly Ala Tyr Leu Asn Gly
130 135 140

Lys Pro Ile Lys Val Ser Ser Gln Ser Glu Leu Val Lys Ser Leu Leu
145 150 155 160

Gly Thr Glu Val Gly Thr Thr Arg Asp Asn Leu Thr Val Glu Thr Thr
165 170 175

Thr Arg Arg Ile Asn Asn Leu Leu Phe Lys Val Arg Ser Leu Arg Met
180 185 190

Cys Gly Ser Cys Ala Leu Asp Leu Cys Trp Val Ala Cys Gly Arg Leu
195 200 205

Glu Leu Phe Tyr Leu Ile Gly Tyr Gly Gly Pro Trp Asp Val Ala Gly
210 215 220

Gly Ala Val Ile Val Lys Glu Ala Gly Gly Val Leu Phe Asp Pro Ser
 225 230 235 240
 Gly Ser Glu Phe Asp Ile Thr Ser Gln Arg Val Ala Ala Thr Asn Pro
 245 250 255
 His Leu Lys Glu Ala Phe Val Glu Ala Leu Gln Leu Ser Glu Tyr Val
 260 265 270

Ser

<210> 22
 <211> 268
 <212> PRT
 <213> Lycopersicon esculentum

<400> 22
 Met Ala Gln Asn Gly Ser Val Glu Gln Phe Leu Asp Val Ala Val Glu
 1 5 10 15
 Ala Ala Lys Lys Ala Gly Glu Ile Ile Arg Glu Gly Phe Tyr Lys Thr
 20 25 30
 Lys His Val Glu His Lys Gly Met Val Asp Leu Val Thr Glu Thr Asp
 35 40 45
 Lys Ala Cys Glu Asp Phe Ile Phe Asn His Leu Lys Gln Arg Phe Pro
 50 55 60
 Ser His Lys Phe Ile Gly Glu Glu Thr Thr Ala Ala Cys Gly Asn Phe
 65 70 75 80
 Glu Leu Thr Asp Glu Pro Thr Trp Ile Val Asp Pro Leu Asp Gly Thr
 85 90 95
 Thr Asn Phe Val His Gly Phe Pro Phe Val Cys Val Ser Ile Gly Leu
 100 105 110
 Thr Ile Glu Lys Lys Pro Thr Val Gly Val Val Tyr Asn Pro Ile Ile
 115 120 125
 Asp Glu Leu Phe Thr Gly Ile Asp Gly Lys Gly Ala Phe Leu Asn Gly
 130 135 140
 Lys Pro Ile Lys Val Ser Ser Gln Ser Glu Leu Val Lys Ala Leu Leu
 145 150 155 160
 Ala Thr Glu Ala Gly Thr Asn Arg Asp Lys Leu Val Val Asp Ala Thr
 165 170 175
 Thr Gly Arg Ile Asn Ser Leu Leu Phe Lys Val Arg Ser Leu Arg Met
 180 185 190
 Cys Gly Ser Cys Ala Leu Asn Leu Cys Gly Val Ala Cys Gly Arg Leu
 195 200 205
 Asp Leu Phe Tyr Glu Leu Glu Phe Gly Gly Pro Trp Asp Val Ala Gly
 210 215 220
 Gly Ala Val Ile Val Lys Glu Ala Gly Gly Phe Val Phe Asp Pro Ser
 225 230 235 240
 Gly Ser Glu Phe Asp Leu Thr Ala Arg Arg Val Ala Ala Thr Asn Ala
 245 250 255

His Leu Lys Asp Ala Phe Ile Lys Ala Leu Asn Glu
 260 265

<210> 23
 <211> 287
 <212> PRT
 <213> Synechocystis sp.

<400> 23
 Met Thr Ser Ala Gln Lys Pro Val Phe Ser Pro Ser Asp Leu Gln Thr
 1 5 10 15
 Trp Leu Glu Ile Ala Thr Glu Ala Val Leu Ala Ala Gly Ala Glu Ile
 20 25 30
 Phe Ser Leu Trp Gly Lys Val Gln Gln Ile Gln Glu Lys Gly Arg Ala
 35 40 45
 Gly Asp Leu Val Thr Glu Ala Asp Arg Gln Ala Glu Ala Ile Ile Leu
 50 55 60
 Glu Ile Ile Lys Arg Arg Cys Pro Asp His Ala Ile Leu Ala Glu Glu
 65 70 75 80
 Ser Gly Gln Leu Gly Gln Val Asp Asn Pro Phe Cys Trp Ala Ile Asp
 85 90 95
 Pro Leu Asp Gly Thr Thr Asn Phe Ala His Ser Tyr Pro Val Ser Cys
 100 105 110
 Val Ser Ile Gly Leu Leu Ile Gln Asp Ile Pro Thr Val Gly Val Val
 115 120 125
 Tyr Asn Pro Phe Arg Gln Glu Leu Phe Arg Ala Ala Thr Ser Leu Gly
 130 135 140
 Ala Thr Leu Asn Arg Arg Pro Ile Gln Val Ser Thr Thr Ala Ser Leu
 145 150 155 160
 Asp Lys Ser Leu Leu Val Thr Gly Phe Ala Tyr Asp Arg Val Lys Thr
 165 170 175
 Leu Asp Asn Asn Tyr Pro Glu Phe Cys Tyr Leu Thr His Leu Thr Gln
 180 185 190
 Gly Val Arg Arg Ser Gly Ser Ala Ala Ile Asp Leu Ile Asp Val Ala
 195 200 205
 Cys Gly Arg Leu Asp Gly Tyr Trp Glu Arg Gly Ile Asn Pro Trp Asp
 210 215 220
 Met Ala Ala Gly Ile Val Ile Val Arg Glu Ala Gly Gly Ile Val Ser
 225 230 235 240
 Ala Tyr Asp Cys Ser Pro Leu Asp Leu Ser Thr Gly Arg Ile Leu Ala
 245 250 255
 Thr Asn Gly Lys Ile His Gln Glu Leu Ser Gln Ala Leu Ala Ala Thr
 260 265 270
 Pro Gln Trp Phe Gln Gln Tyr Ala Ala Ala Arg Ala Gln Lys Ile
 275 280 285

<210> 24
 <211> 267

<212> PRT
 <213> Synechocystis sp.

<400> 24

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Met Leu Pro Glu Val Glu Gln Arg Leu Phe Ile Ala Gln Gln Leu Ala
 1          5          10          15
Ala Val Ser Gly Glu Ile Leu Ile Gln Tyr Phe Arg Arg Ser His Leu
          20          25          30
Gln Gly Gly Thr Lys Ile Asp Gln Val Ser Ala Ile Val Thr Gln Ala
          35          40          45
Asp Glu Glu Ala Glu Gln Ala Met Val Asp Leu Ile Gln Ala Gln Phe
          50          55          60
Pro Gln Asp Gly Val Ile Arg Glu Glu Gly Lys Asn Ile Ala Gly Lys
          65          70          75          80
Ser Gly Tyr Thr Trp Val Leu Asp Pro Ile Asp Gly Thr Ser Ser Phe
          85          90          95
Val Arg Gly Leu Pro Ile Phe Ala Thr Leu Ile Gly Leu Val Asp Ala
          100          105          110
Asp Met Arg Pro Val Leu Gly Ile Ala His Gln Pro Ile Ser Gly Asp
          115          120          125
Arg Trp Gln Gly Val Gln Gly Glu Gln Ser Asn Val Asn Gly Ile Pro
          130          135          140
Leu Val Asn Pro Tyr Lys Ala Ser Glu Ile Asn Leu Thr Ala Ala Cys
          145          150          155          160
Ile Val Ser Thr Thr Pro Leu Met Phe Thr Thr Pro Val Gln Gln Gln
          165          170          175
Lys Met Ala Asp Ile Tyr Arg Gln Cys Gln Arg Thr Ala Phe Gly Gly
          180          185          190
Asp Cys Phe Asn Tyr Leu Ser Ala Ala Ser Gly Trp Thr Ala Met Pro
          195          200          205
Leu Val Ile Val Glu Ala Asp Leu Asn Phe Tyr Asp Phe Cys Ala Leu
          210          215          220
Ile Pro Ile Leu Thr Gly Ala Asn Tyr Cys Phe Thr Asp Trp Gln Gly
          225          230          235          240
Lys Glu Leu Thr Pro Glu Ser Thr Glu Val Val Ala Ser Pro Asn Pro
          245          250          255
Lys Leu His Ser Glu Ile Leu Ala Phe Leu Gln
          260          265

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